29. $e^x,\ x^x\ \ln x^x\ \ e^{x/2}$

$\ln x^x\ \ e^{\frac{x}{2}}\ \ e^x\ \ x^x$

33 $3^x\quad \sqrt{9^x+2^x}\quad \sqrt{9^x-4^x}$

$\lim_{x\to\infty} \frac{\sqrt{9^x+2^x}}{3^x}\quad \frac{\infty}{\infty}$

$3^x = \sqrt{(3^x)^2}$

$= \sqrt{3^{2x}}$

$= \sqrt{(3^2)^x}$

$\lim_{x\to\infty} \frac{\sqrt{9^x+2^x}}{\sqrt{9^x}}$

$\lim_{x\to\infty} \sqrt{\frac{9^x+2^x}{9^x}} = \lim_{x\to\infty} \sqrt{1+\frac{2^x}{9^x}}$

$\lim_{x\to\infty} \sqrt{1+\left(\frac{2}{9}\right)^x}$ $\to 0$

1

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8.4 Improper Integrals

∞ – makes the integral improper

$$\int_1^\infty \frac{1}{x^2}\,dx = 1$$

converges to 1

make it proper

$$\lim_{b\to\infty} \int_1^b \frac{1}{x^2}\,dx \overset{?}{=} 1$$

$$\lim_{b\to\infty} \left(-\frac{1}{x}\right)\Big|_1^b = \lim_{b\to\infty} \left(-\frac{1}{b} - -1\right)$$

$$\lim_{b\to\infty} \left(1-\frac{1}{b}\right)$$

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$$\int_1^\infty \frac{1}{\sqrt{x}}\,dx = \lim_{b\to\infty}\int_1^b \frac{1}{\sqrt{x}}\,dx$$

diverges

$$= \lim_{b\to\infty}\int_1^b x^{-\frac{1}{2}}\,dx$$

$$\lim_{b\to\infty} 2x^{\frac{1}{2}}\Big|_1^b$$

$$\lim_{b\to\infty} 2\sqrt{b}-2\sqrt{1}$$

$$\infty$$

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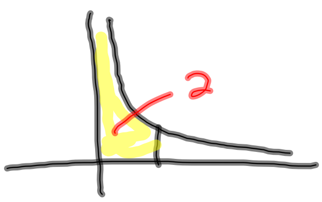
$$\int_0^1 \frac{1}{\sqrt{x}}\,dx = \lim_{b\to 0^+}\int_b^1 \frac{1}{\sqrt{x}}\,dx$$



$$= \lim_{b\to 0} 2x^{\frac{1}{2}}\Big|_b^1$$

$$= \lim_{b\to 0^+}\left(2\cdot\sqrt{1}-2\sqrt{b}\right)$$

$$= 2$$

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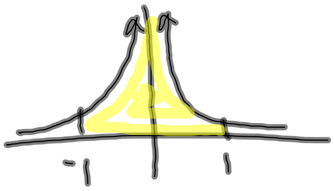
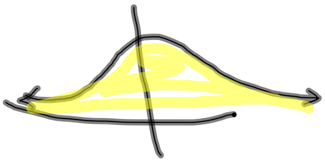
$$\int_{-1}^{1} \frac{1}{x^2}\,dx = \int_{-1}^{0} \frac{1}{x^2}\,dx + \int_{0}^{1} \frac{1}{x^2}\,dx$$



$$= \lim_{b\to 0^-} \int_{-1}^{b} \frac{1}{x^2}\,dx + \lim_{b\to 0^+} \int_{b}^{1} \frac{1}{x^2}$$

Ex5 $$\int_{-\infty}^{\infty} \frac{1}{1+x^2}\,dx = \int_{-\infty}^{0} + \int_{0}^{\infty}$$



$$= \lim_{b\to -\infty} \int_{b}^{0} + \lim_{b\to \infty} \int_{0}^{b}$$

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